

# METAL CASTING

## Project Fact Sheet



## METHOD AND APPARATUS FOR PRODUCTION OF THREE-DIMENSIONAL OBJECTS BY PHOTOSOLIDIFICATION

**NEW RAPID PROTOTYPING METHOD SAVES ENERGY AND CUTS PRODUCTION TIME WITH THE SPEED OF LIGHT**

### Benefits

- Uses 1/78 as much energy per unit volume of solidification compared to laser-scanned, point-by-point systems
- Offers indirect energy savings by reducing the steps required to produce solid parts
- Allows fully automatic fabrication of newly designed complex parts in minutes
- Reduces fabrication cost and time required to create parts
- Prevents deformation of solidified photopolymer during fabrication
- Improves accuracy and resolution
- Allows for the creation of multimaterial objects

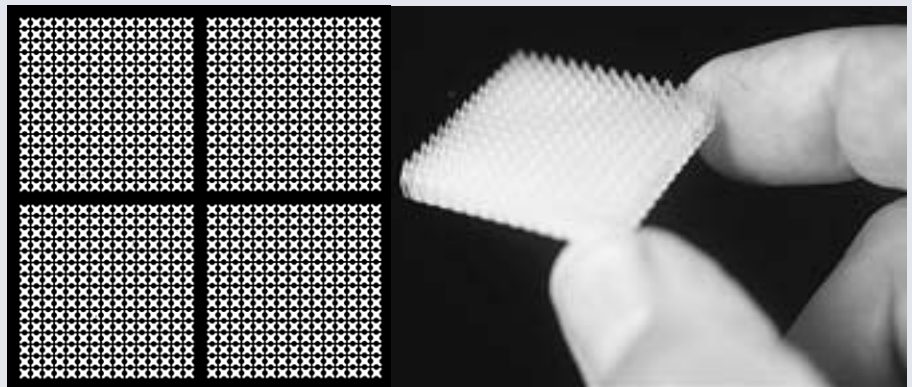
### Applications

This technology can be used for prototyping and actual production of three-dimensional parts. Industries that will likely benefit from the technology include the glass-optical, automotive, aerospace, computer, camera, business machine, and health care industries. In addition to manufacturing applications, photofabrication can also be used in medical tests and scientific investigations.

For years, manufacturers have used rapid prototyping (RP) machines, which hardened materials one point at a time, to fabricate parts in layers. RP machines lower parts into a vat of polymer to cover each new layer with additional raw material. Then, laser light sources are used to harden each liquid photopolymer layer in a point-by-point process. While this method is a vast improvement over previous manufacturing methods that required the building of machined prototypes or wooden mock-ups, a new technology makes part fabrication even faster and easier.

The quick-layering (QL) technology from Light Sculpting, Inc., provides high resolution and speed at low cost by irradiating entire layers at once. The QL technology builds parts on an open platform using a broad-based light source, such as an ultraviolet lamp or other low energy radiation, to harden material layers. Computer aided design (CAD) drives the process, so that newly designed complex parts can be fabricated automatically in minutes. This new technology offers improved accuracy and resolution and prevents deformation during fabrication, all while reducing production time and energy use.

### PRODUCTION OF THREE-DIMENSIONAL OBJECTS BY PHOTOSOLIDIFICATION



The patterned transparency on the left represents one mask layer that helped to create the part on the right through Light Sculpting's photosolidification process.



## Project Description

**Goal:** Develop a fully automated prototype to aid in improving future design and confirming product validity.

Light Sculpting's system fabricates parts by imaging whole layers of liquid simultaneously and attaching one on top of another. Liquid is deposited in a separate layer on the underside of a film apart from the object being formed, so that materials can be varied from layer to layer, as well as within each layer. Imaging is accomplished by flooding irradiation through a mask or negative in contact with the liquid, yielding parts that require no post cure. A special thin material is used in between the mask and the polymer to prevent distortion or breakage and to provide easy separation by sliding or peeling.

Light Sculpting, Inc., developed this new technology with the help of a grant funded by the Inventions and Innovation Program in the Department of Energy's Office of Industrial Technologies.

## Progress and Milestones

- Work under the Inventions and Innovation grant has been completed.
- Inventor is currently seeking partners and investors for the technology.
- Protected by U.S. patents 4,752,498 and 4,801,477.

## Economics and Commercial Potential

The invention appears to have good commercial potential because it is significantly faster and more economical than competing technologies. It offers substantial reductions in engineering design time and time for new product development, which will eventually allow prototype-manufacturing time to go from months to weeks. Since desktop manufacturing is becoming a competitive tool in manufacturing, commercial acceptance of the technology seems assured.



The Inventions and Innovation Program works with inventors of energy-related technologies to establish technical performance and to conduct early development. Ideas that have significant energy-savings impact and market potential are chosen for financial assistance through a competitive solicitation process. Technical guidance and commercialization support are also extended to successful applicants.

For project information, contact:

### Dr. Efrem Fudim

Light Sculpting, Inc.  
4465 N. Oakland Avenue  
Milwaukee, WI 53211-1662  
Phone: (414) 964-5737  
Fax: (414) 964-5737  
lightsculpting@earthlink.net  
home.earthlink.net/~lightsculpting

For more information about the Inventions and Innovation Program, contact:

### Lisa Barnett

Program Manager  
Inventions and Innovation Program  
Phone: (202) 586-2212  
Fax: (202) 586-7114  
lisa.barnett@ee.doe.gov

Visit our home page at  
[www.oit.doe.gov](http://www.oit.doe.gov)

Office of Industrial Technologies  
Energy Efficiency and  
Renewable Energy  
U.S. Department of Energy  
1000 Independence Avenue SW  
Washington, D.C. 20585-0121



Order # I-MC-543  
December 2001